Lucintel
Insights that Matter

ASSESSING THE IMPACT OF COVID-19 ON VARIOUS INDUSTRIES

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COVID 19 – Assessing its Impact

>$2.5 Trillion *loss in the Global GDP*

>$1.0 Trillion *loss in the US GDP*

305 Million *people lost jobs Globally*

30 Million *people lost jobs in the US*

3.2 Million *(0.04%) infected globally by April*

1.1 Million *(0.3%) infected in the US by April*

5% to 30% *drop in revenue in most industries globally*

10% to 40% *drop in revenue in most industries in the US*

Shutdown – *plants, schools, travel, and non-essential stores closed*

Navigating through crisis –
managing liquidity, demand, workers safety and supply chain security are key objectives

Contents

1. Current Economic Situation

Most countries around the globe have been affected by the Coronavirus pandemic. This virus, which emerged in China in November 2019, has killed over 100,000 people in 4 months and infected over 3 million people around the world. As businesses have shut down to comply with government stay-at-home orders, workers have been laid off at an unprecedented pace. In the United States, the unemployment rate, which stood at 3.5% in February, spiked to roughly 20% on April 26, 2020. In the last 5 weeks, 26 million people filed unemployment claims. One in 6 Americans now find themselves without a job. Travel, tourism and restaurant businesses have been impacted immediately and severely.

Various economists are projecting that the global GDP will go down by 3% to 6% in 2020. A recent forecast from the IMF on April 24, 2020 suggests that the world economy may decline by -3% in 2020 post-COVID (a roughly $2.6 trillion decline). By contrast, the pre-COVID estimates projected growth of more than 4% in 2020, hypothetically adding more than $3.5 trillion to the global economy as shown in the figure below. The global GDP was estimated at $86.5 in 2019.

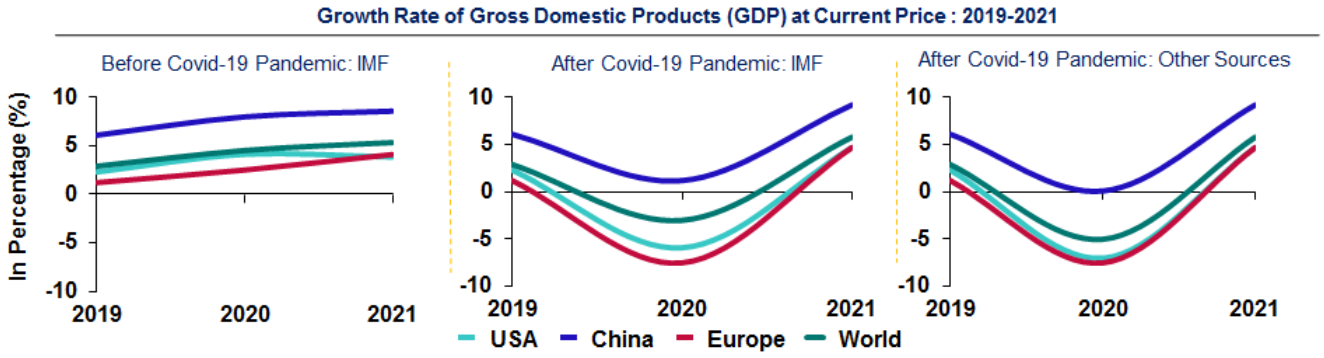

Figure 1: World GDP Forecast as of 28th April, 2020 (Source: Lucintel Analysis, IMF, Fitch, S&P, Goldman Sachs, etc.)

The biggest challenge is that we do not yet know whether we'll be able to bounce back quickly or if it will take another 12 to 24 months to recover the from the loss this virus has effected in our economy, safety, and health. In addition, it is difficult to anticipate the impact to culture and resulting consumer behaviors, international trade relations, and new regulations regarding the health and safety standards of products made in a post-COVID world. The goal of governments around the world is to keep workers employed and firms afloat so that when the pandemic settles, the economy can bounce back quickly without massively disrupting the supply chain.

2. Impact of Coronavirus on Industries

Most of the industries tracked in this report have been hit extremely hard by the COVID-19 crisis - even harder in some cases than the 2008-2009 financial crisis. The impact is severe and there are still a lot of uncertainties about when the market will recover. The table below compares the recession of 2009 with the 2020 COVID pandemic.

Table 1: Comparison of 2009 Recession with 2020 recession. (Source: Lucintel)

Industry	Change in 2009 Recession	Change in 2020 due to COVID-19
Global GDP	-5%	-3% to -6%
Global Automotive	-12%	-23%
Global Aerospace	-24%	-24%
Global Wind Energy	43%	10%
Global Construction	-5%	-14%
Global E&E	10%	-9%
Global Chemical	-19%	-8%

Table 2: Impact of COVID Pandemic on 6 Major Industries. Market at OEM level. (Source: Lucintel)

Industry	Market Size in 2019	Forecast for 2020	Forecast for 2021
Global Automotive (Car & LCV)	~$2,000 B	-20% to -30%	20% to 25%
Global Aerospace (Aircraft)	~$250 B	-20% to -30%	-2% to -4%
Global Wind (Turbine)	~$55 B	10% to 15%	4% to 6%
Global Construction	~$8,945 B	-10% to -20%	5% to 7%
Global Consumer Electronics	~ $1,129 B	-6% to -10%	6% to 10%
Global Chemical	$3,075 B	-6% to -10%	8% to 12%

The fundamental nature of the challenge today is different than what we faced in 2009. Many people lost a large portion of their savings in 2009, but they were able to keep their jobs, which kept supply chains moving, and allowed businesses to stay open. The financial impact to the consumer in this recession is likely to be more dramatic because many more people are losing their incomes, which will likely slow economic recovery. To highlight the scale of this challenge, consider that consumer spending contributes roughly 70% to the GDP of the U.S.

In this research report, Lucintel has looked into the impact of COVID-19 in 6 industries as shown in previous charts. In 2020, we project a decline of ~15% collectively across all 6 industries, including automotive, aerospace, E&E, chemical, wind, and construction from $15.2 trillion at the OEM level in 2019.

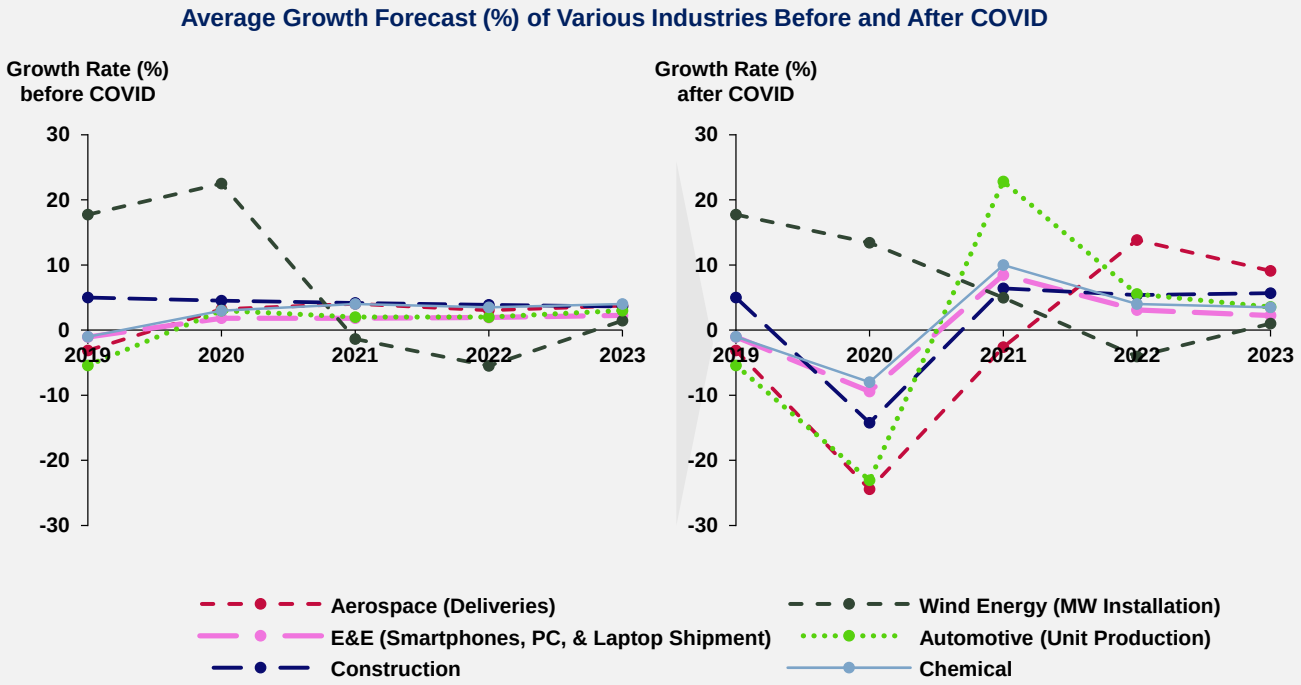

Figure 2: Average Growth Forecast (in Percentage) of Various Industries before and after COVID (Source: Lucintel, primary research). The market rebound for 2021 - 2023 is based on a historical analysis of the 2009 recession, and primary research.

Our research shows that these 6 industries are forecast to see a large drop in revenue in 2020 as a result of the Coronavirus pandemic. In 2020, the aerospace, automotive, E&E, construction, and chemicals industries are expected to decline by 10% to 30% in revenue at the OEM level and thus the whole supply chain will be affected in the above industries. The biggest drop will be in the aerospace industry. In addition to airlines, hospitality, tours and travel are amongst the most severely

impacted industries and are expected to decline by 40% - 50% in 2020. Airlines today are operating at very low occupancy and have grounded about 50%-100% of their fleet.

The chart below shows the impact of COVID-19 in the 6 industries discussed in various regions. As you will see, APAC is slowly in the process of recovering, because China has restarted its production after gaining control over the spread of the Coronavirus. South Korea and Japan have shown promising improvements in controlling the spread of the virus.

In the next section, the impact to these 6 industries in the post-COVID market is discussed.

2.1 Impact of Coronavirus on Automotive

The automotive industry employs about 5.5 million direct and indirect workers at the manufacturing and retail trade levels in the US, while globally it employed more than >60 Million people in 2019. The impact of the corona virus is huge for the automotive industry. The industry is faced with liquidity challenges, demand uncertainty, supply chain issues and workers safety as discussed below.

Liquidity is one of the biggest concerns for the automotive industry, which will struggle for survival if the recovery does not happen in the next 6 months. On average, the top 5 OEMs lose $2 billion to $2.5 billion per month. With such a high burn rate, survival for some OEMs is 3 months to 4 months under the current situation. To minimize the burn rate, automotive companies have been laying off or reducing the salaries of employees. Companies like GM and Ford have suspended their dividends for the first quarter. To maintain liquidity, Ford has sold three bonds with a total principal value of $8 billion. GM intended to drawdown $16 B from its revolving credit facility.

Interviews with major OEMs, such as GM and Ford, suggest a decline of 20% - 30% in overall industry revenue based on decreased demand in 2020 due to COVID-19. With stay at home orders and other health issues, major OEMs such as VW, BMW, FCA, Toyota, Nissan,

JLR, Ford, GM, PSA, Lamborghini, Ferrari, and Maserati have halted the production of vehicles until the end of April 2020 in an effort to prevent the spread COVID-19.

The automotive industry relies heavily on cross-border shipments of parts for car manufacturing, so shutdowns in certain regions can have a rippling effect on the global industry value chain.

While the situation in China is starting to stabilize, the industry is closely watching, at times pressuring, to see when US and European car manufacturers will resume normal production. At the same time, several automotive OEMs are starting to shift engineering, assembly and even procurement capacities to produce and source medical equipment. Regardless of whether continued lockdowns are required by health and safety enforcement, much of the damage is already done. Legislative inaction, declining demand, a lack of parts in the supply chain, and related factors have together created significant job losses in the automotive industry, which will severely impact GDP.

Workers safety is a primary concern as businesses consider when to open. The automotive industry is actively preparing for a wave of plant re-openings. Restarting production requires coordination with suppliers, changing work processes to allow for proper social distancing and obtaining or producing needed PPE supplies. Plant shut downs are costing the companies billions by the week in lost production.

In the automotive industry, almost 50% of white-collar employees can work from home without much loss of productivity, and this will help during this pandemic. Engineers, who are working to develop products or test specimens may be required to work from labs and offices. However, it is not feasible for plant workers and production staff that are involved in component manufacturing or in the assembly line to work remotely. If infections spread among people working at factories and assembly lines, then it could drastically reduce production capacity as well as create a significant financial liability to the company. Therefore, workers safety has become the big issue and employees are instructed to wear gloves and masks at all times to maintain safety. Above issues are summarized in below figure.

The automotive industry will lose about $460 billion at the OEM level (roughly 23% revenue loss) in 2020 as a result of the Coronavirus pandemic. The automotive industry is facing its biggest existential threat since the Great Recession. A majority of the car manufacturing plants remain shut down in the US, Europe and Asia. Almost all the automotive

manufacturers have observed significant downfall in last three months. Sales and production challenges are made worse by supply chain issues, workforce health challenges etc. Though the companies are planning to go back to production in May – June, it is expected that the recovery will be slow as companies need to follow the strict safety measures while re-engaging their workforce. Companies will also have to scale the workforce in order to adjust to the decreased demand through the recovery. The end of 2020 may usher in some relief to manufacturers as businesses reopen, but low consumer confidence and diminished buying power are likely to be lingering challenges for a recovery in the automotive industry.

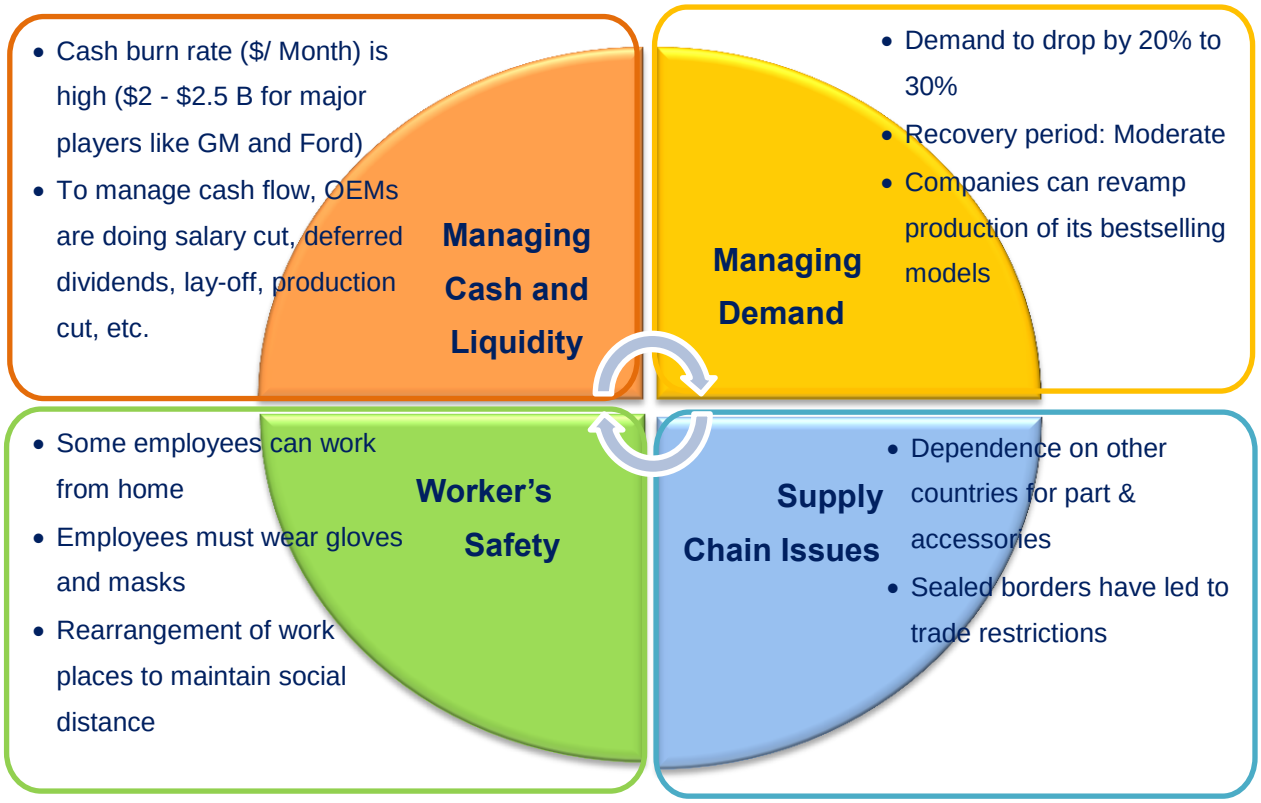

Figure 3: Navigating Through the Crisis in the Automotive Industry (Source: Lucintel)

"We temporarily shut down vehicle and engine production factories in the US and Europe due to the spreading of Coronavirus. We have also planned to cut the salary of top executives from 20% to 50% of their salaries for at least four to five months as it attempts to manage through the Coronavirus pandemic." ***Ford, USA***

"Operations have been affected for JLR (Jaguar Land Rover). We have suspended our operation in UK till 20th of April, due to the outbreak of Coronavirus. We expect significant decline in the revenue for the year 2020." ***JLR, UK***

2.2 Impact of Coronavirus on Aerospace

The aerospace industry employs >5 million direct and indirect people in the US, while globally it employs >10 million individuals at the manufacturing level. The impact of the corona virus is huge for the aerospace industry, since the commercial airline industry has almost stopped functioning due to restrictions on travel. As a result, the industry is facing a demand challenge, liquidity issues, supply chain issues, and workers safety as shown in the figure below.

Cash / liquidity is one of the biggest concerns for the aerospace industry if the recovery does not happen in the next 6 - 12 months. Major OEMs such as Boeing and Airbus have a burn rate of $2.5 B - $3.5 B per month. To minimize the burn rate, airlines and OEMs had been laying off & furloughing people or reducing the salary of employees. Interviews with major OEMs, such as Boeing and Airbus, suggest a decline of 20% - 30% in the overall industry revenue based on travel bans in 2020 due to COVID-19. Major OEMs and tier players have called for shutdowns and announced production cuts of certain aircraft models. Airbus announced that it would cut production by 30% amid the virus outbreak.

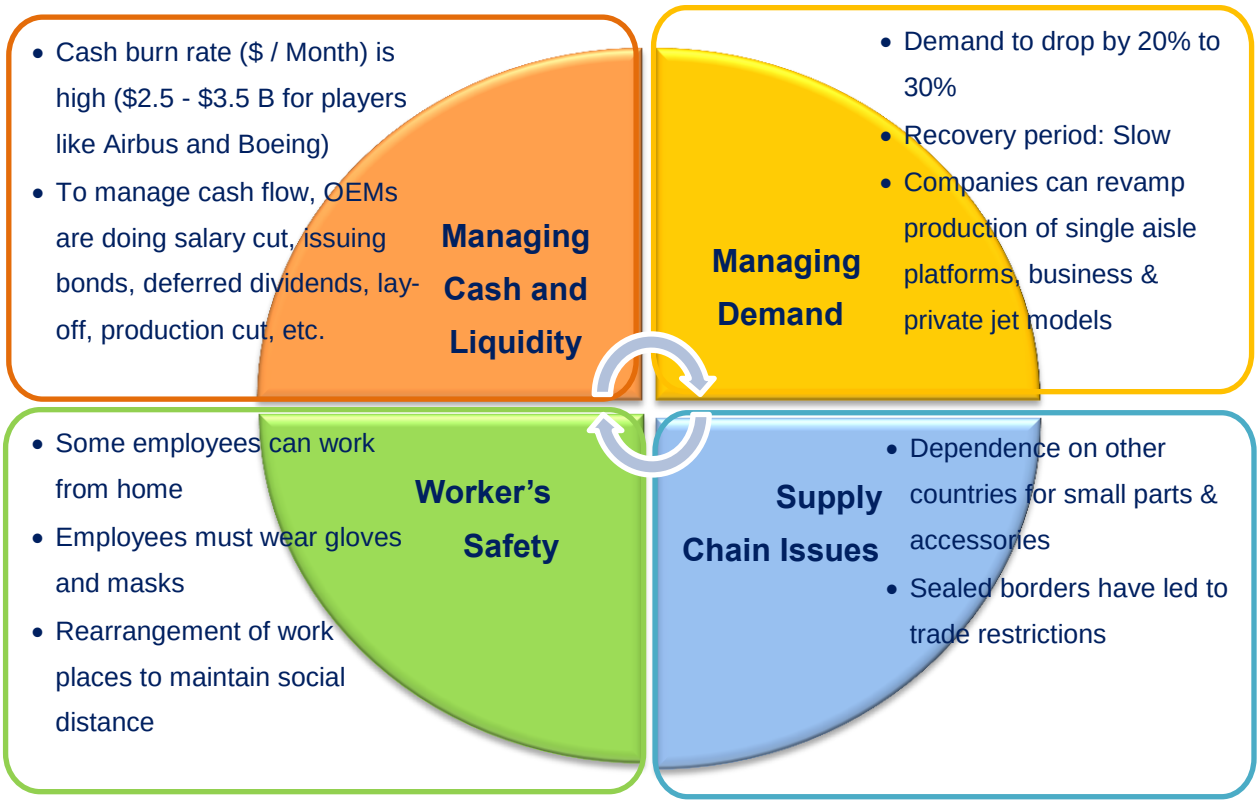

Figure 4: Navigating Through the Crisis in the Aerospace Industry (Source: Lucintel)

"We have temporarily suspended our operations in the Puget Sound facility for two weeks. This facility is responsible for almost our entire commercial and defense aircraft production activity. We expect that the recovery will start in late Q3 or early Q4, but that's a high-level guess because the severity and impact is unrivalled to any situation we encountered in the past."

Boeing, USA

"We have partially resumed our production and assembly work in all our major facilities including Spain, France, and China. We have slowed down the production in the UK also. We are still reviewing the current scenario, but see a steep decline in the revenue this year, due to order cancellation or production delays."

Airbus, UK

Airbus has announced measures to bolster its liquidity and ensure financial flexibility. To improve its liquidity, Airbus has withdrawn its proposed 2019 dividend, suspended the voluntary top up in pension funding, leveraged its credit, etc. The total liquidity available to Airbus now amounts to approximately $30 billion. To maintain liquidity, the company is also minimizing its operational cash requirement.

Major US aerospace manufacturer Boeing reported a $641 Million loss in the first quarter of 2020. It is planning to cut 10%-15% of jobs by voluntary and involuntary layoffs and will scale back production of its main commercial planes, including the 787 and 777. Boeing had requested $60 billion in support from the U.S. Government to increase liquidity, but later generated $25 billion cash through a bond offering. The US government has supported the airlines with $50 billion in liquidity; support to the airlines will also help tier players during the crisis.

The commercial aerospace industry will lose about $60 billion at the OEM level (roughly 23% revenue loss) in 2020 as a result of the Coronavirus pandemic. The recovery of the aerospace industry may come slowly, compared to other industries. According to the CEO of Airbus, “There will be a recovery, but it may take a couple of years to get back to where we were a couple of weeks ago. The current situation is steeper and longer, but I think air travel will recover”. Below are the major factors that will affect the recovery of the aerospace industry:

- Most of the borders are sealed and air travel can’t pick up or reach normal levels until the virus is conquered worldwide and international borders are reopened.
- Airline business has declined sharply with massive cancellations, and restrictions by governments. It is expected that airlines may defer or cancel new aircraft deliveries in 2020 or possibly longer.
- Hesitation to travel in aircraft due to difficulty of maintaining social distancing.

Major OEMs such as Boeing and Airbus have also started preparation to return to work. Workers safety is a critical concern when businesses decide when to reopen. Companies are taking all safety measures seriously and following government guidelines. Boeing has started its production with nearly 17% of its workforce in the Seattle area. Airbus has furloughed around 3,000 (~50%) people at its UK wings plant, whose workstations can’t meet social distancing requirements. OEMs are also allowing work from home, wherever possible. Apart from that if an employee has a high risk of infection with COVID, needs to care for children,

has a sick family member or is worried about working at the facilities due to the pandemic, then they have options to take vacation, sick leave, LOP, etc.

In the aerospace industry, 15%-25% of employees can work from home without much loss of productivity, and this will help during the pandemic. Engineers, who have to develop products or test specimens may be required to work from labs and offices. It is difficult to work from home for plant workers and technicians.

In the aerospace industry, supply chain issues are not that serious as compared to the automotive and electronics industries, where a significant percentage of the critical components are made in China and other parts of the world. Aerospace materials, nacelles, wings components, etc. are produced all around the world. However, there is some dependency in procurement of components from many countries, and cross-border shipments and travel restrictions pose a challenge for starting production. Tier players are also facing similar challenges from shutdowns, which can worsen supply chain disruption for major OEMs and impact the availability of critical components. Due to severe restrictions on international travel, the aerospace industry supply chain has been hit hard by the COVID-19 pandemic.

2.3 Impact of Coronavirus on E & E

The E&E (Electronics & Electrical) industry employed more than 1 million direct and indirect people at the manufacturing and non-supervisory levels in the US, while globally it employed about 16 million people in 2019. The impact of COVID is mild for the E&E industry. The industry is faced with challenges, such as demand uncertainty, supply chain issues, and workers safety as shown in the figure below.

The electronics industry is in a much healthier position than the automotive and aerospace industries because the drop in demand is not as severe comparatively. Moreover, major electronics OEMs have good cash on their balance sheets, and therefore, cash & liquidity challenges are not as big a threat when compared to other industries. The burn rate (fixed cost) for major OEMs such as Apple and Samsung is about $2.5 to $3.5 billion per month. Interviews with major manufacturers, such as Apple, Foxconn, and Samsung, suggest a decline of ~10% in the overall industry revenue based on decreased demand in 2020 due to COVID-19. With stay home orders and other health issues, major companies have halted production and also face supply chain disruptions. Companies are looking for ways to increase efficiency and managing inventories to reduce working capital.

E&E manufacturing companies are significantly affected by supply chain challenges, because of the industry's reliance on the APAC region for the supply of critical components. Though China's plants are restarting operations, Apple's and other OEMs' stores are closed in the US, Europe, and other regions, affecting demand for electrical & electronic products. International trade restrictions & delays are affecting the supply chain of E&E severely. Manufacturers are closely working with supply chain partners to anticipate the demand and plan for the recovery.

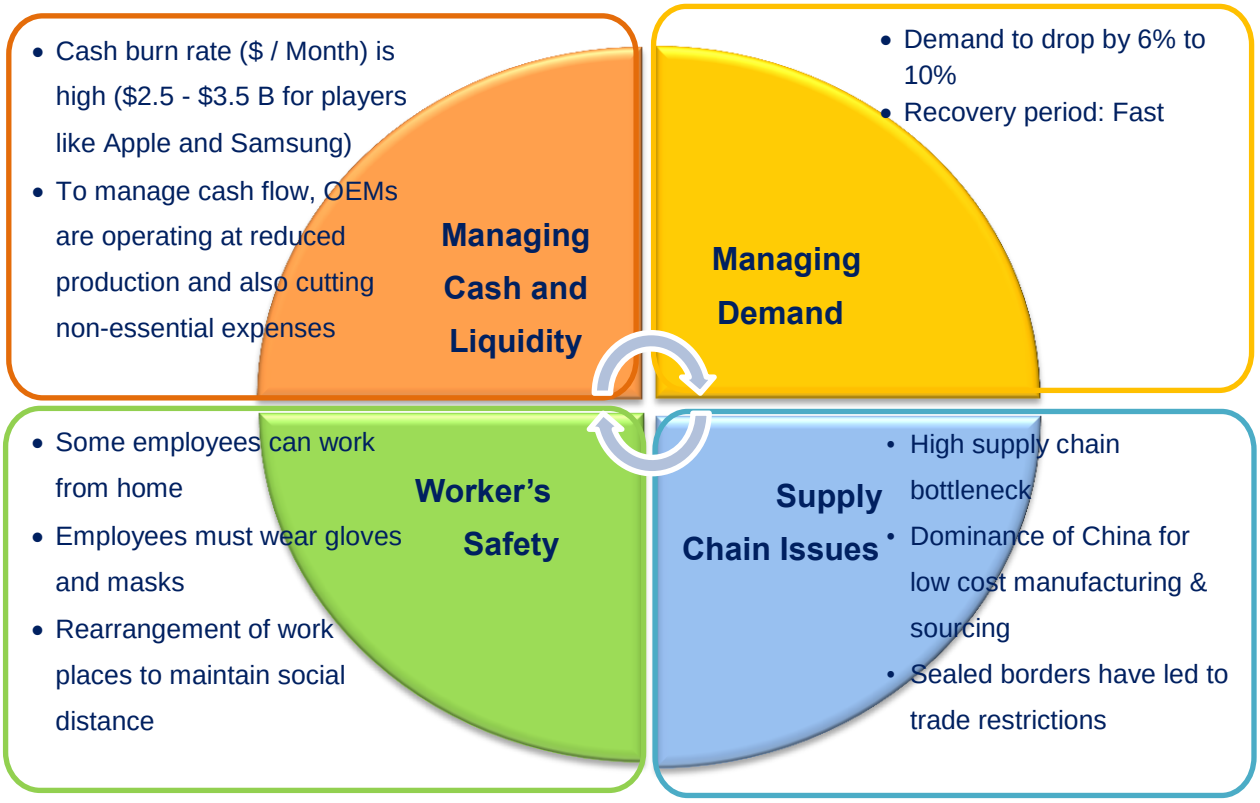

Figure 5: Navigating Through the Crisis in the E & E Industry (Source: Lucintel)

FOXCONN

"We expect the revenue to suffer this year because of the disruption caused by Covid-19. We have opened our production facility after the shutdown and are cautiously running it to meet the demand. The demand for products has also slowed down. We are currently operating at only 25% of our actual capacity." ***Foxconn, China***

SAMSUNG

"Operations have been affected, new models put on hold and our stores are closed. This is likely to impact our revenues in the coming year. We hope the situation gets better and the virus gets contained soon." ***Samsung, South Korea***

Worker's safety is a critical concern determining when businesses should reopen. Renewed production in the E&E industry has already commenced with reduced utilization and fewer employees. In the E&E industry, 15% - 25% of the employees can work from home without much loss of productivity, and this will help during the pandemic. Companies are facing absenteeism challenges and operating at lower production volumes due to low demand.

Rising unemployment is reducing the average consumer's purchasing power, thus affecting demand for new smartphones, PCs and other consumer electronics sales. Interviews suggest that Apple, Samsung and other major OEMs are predicting a considerable decline in revenue in 2020, and a delay in new product launches could also compound the impact. Companies are actively tracking the supply and demand channels to make operational adjustments in order to scale their production to the demand.

2.4 Impact of Coronavirus on Construction

In 2019, the construction industry in the US employed more than 8 million individuals, while at the global level it employed more than 200 million individuals.

The current global shutdown has halted many construction projects globally, mainly affecting the mid-level, subcontractors. The construction industry is expected to see a significant decline in the year ahead.

The burn rate (fixed cost) for the construction industry at the builders level is $0.4 to $0.6 billion per month for major builders. Liquidity issues in the construction industry are less severe when compared to other industries like automotive and aerospace. To minimize the burn rate, construction companies had been increasing liquidity by adjusting operations, and by controlling debts.

The industry is also anticipating a possible supply chain bottleneck for key resources including equipment and materials. This will cause project delays and reduce spending on future projects. The construction market in the US and EU is dependent on imports from China. Now that borders are sealed, and trade is restricted, supply chain issues are likely to arise. Above issues are summarized in below figure.

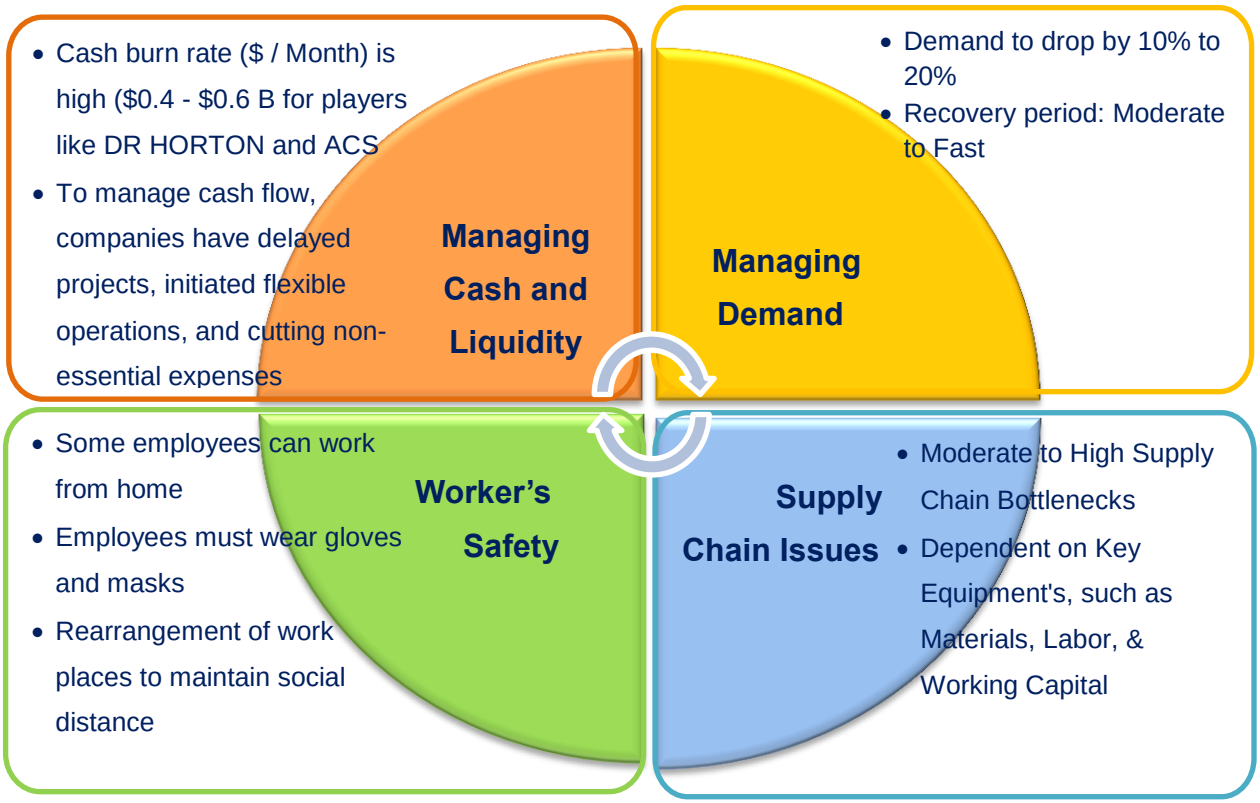

Figure 6: Navigating Through the Crisis in the Construction Industry (Source: Lucintel)

"We anticipate about a 10% decrease to construction in 2020. Ongoing projects will continue, but we expect a drop in Q4 and Q1, 2021 as government funding shifts, and fewer shovel-ready projects are prepared to start" ***Composite Advantage, USA***

"We were able to avoid several supply chain issues in this covid situation, as we're a big company and were able to lock in orders with suppliers. But we're struggling with regards to shipping and getting products out to our customers, so there has been an increase in the cost of shipping to our customers. We are seeing a similar challenge in terms of raw material supply. The cost has gone up a little on the front end and the back end for shipping"

Strongwell, USA

Workers safety is a critical concern when businesses decide when to reopen. Companies are expected to follow protocols to protect employees from COVID. They are practicing social distancing, measuring body temperatures at regular intervals, and implementing other health and safety standards recommended by regulatory bodies.

In the construction industry, 5% to 15% of the employees can work remotely without much loss of productivity, and that will be a major challenge during the pandemic. Designers and architects may be able to work from home, but it is not be possible for construction workers.

Unemployment will impact the construction market. With less purchasing power, investment in new housing projects will decline. This will reduce demand in the global construction market.

2.5 Impact of Coronavirus on Wind Energy

The wind energy industry in the US employs >0.1 million direct and indirect people, while at a global level, the wind industry employed more than 1.2 million individuals in 2019

The energy sector provides an essential service. Fortunately, the impact of COVID is low in wind energy compared to other industries. Still, the Industry is facing challenges with demand uncertainty, supply chain issues and workers safety as shown in the figure below.

The burn rate (fixed cost) for the wind energy industry at the OEM level is <$0.5 B. With stay home orders, supply chain issues and other health issues, major companies have halted the production and construction of new farms to prevent the spread of COVID-19. Major players are using salary cuts, furloughs, and layoffs to help minimize labor costs to improve liquidity. Vestas has announced the elimination of 400 jobs. Vestas and Siemens Gamesa have abandoned their 2020 financial guidance due to uncertainties from COVID.

The supply chain in the wind energy has also been affected by the COVID-19 pandemic, much like other manufacturing industries. Turbine nacelles, components, and materials are produced all around the world and companies do utilize central-purchasing policies, which makes wind energy a truly global business where companies are connected to each other irrespective of national boundaries. Although most wind-related manufacturing remains in

operations, production of some turbine assembly & component manufacturing plants have been temporarily halted in Spain, Italy, UK and India. Production and construction plans of major players like Siemens Gamesa and GE have been disrupted due to delays in the supply of parts and materials.

The majority of Europe's wind turbine and component plants have restarted production after a short break. Safety measures are being implemented within production sites to comply with Government recommendations. Workers safety is critical across the globe; due to supply chain issues Siemens Gamesa furloughed 100 employees at its Iowa facility, and 200 employees at its Kansas facility.

In the wind energy industry, designers may be able to work from home, but it is not possible for production workers required to handle manufacturing equipment and plant operations. Employees' absenteeism could also hamper construction activities.

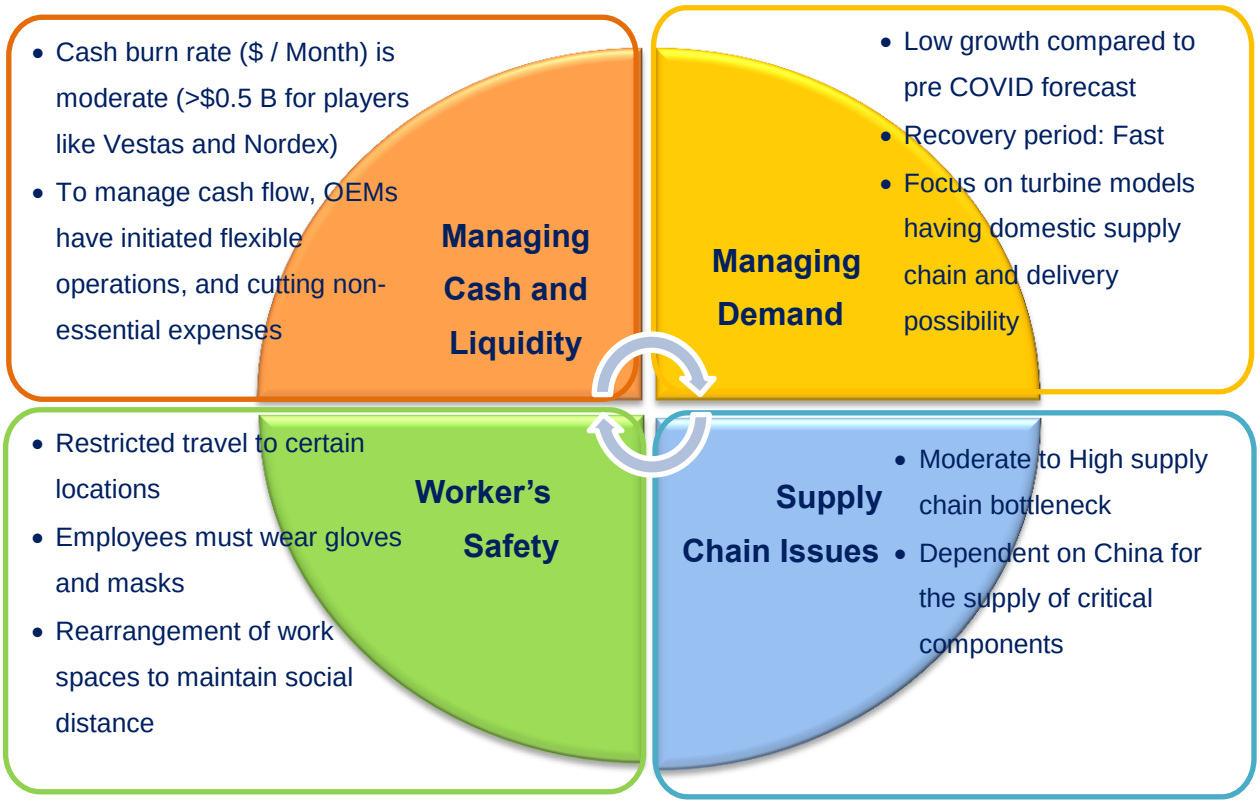

Figure 7: Navigating Through the Crisis in the Wind Energy Industry (Source: Lucintel)

"We have shut down some of our European plants in Castellon and Leon. We are hoping that this impact will not affect the broader market and turbine installation globally."

GE Renewables Energy, US

"The Covid-19 impact will be moderate in the production lines of turbine blades. Some plants in Europe have been affected due to this virus. The plant in Spain has been on lockdown due to this virus. We have also had to layoff some employees from our Europe facility to maintain liquidity."

The wind energy industry is expected to grow at a >10% growth rate, which is lower than pre-COVID projections. The change is due to supply chain issues, and production shutdowns. The recovery of the wind energy industry is expected to coincide with the restart in production, and relaxation in lockdowns from the Governments in major hubs of wind production.

2.6 Impact of Coronavirus on Chemical

In 2019, the global chemical industry employed about 15 million people while in the US, it employed more than 0.8 million individuals. The impact of COVID is huge for the chemical industry.

Chemical industry players have moderate cash reserves and better operating flexibility during the crisis. Many are repurposing their facilities for different, more critical chemicals. The burn rate (fixed cost) for the chemical industry at the manufacturer level is about $0.7 to $1.4 billion / month for major suppliers. Interviews with major manufacturers, such as BASF, LyondellBasell, and Dow Chemical Companies, suggest a decline of 5% - 15% in the overall industry revenue based on the decreased demand in 2020 due to COVID-19. With stay home orders and other health issues, major companies have halted their production or repurposed for production of critical chemicals in the fight against COVID-19. Companies are working to maximize efficiencies, managing inventories to reduce working capital, deferring planned maintenance to save cash, and increasing liquidity. There is less focus on M&A or repurchases, as companies are taking a long-view of the recover, and preparing to sustain as long as possible.

Chemical manufacturing companies are mildly affected by the supply chain issues as companies have fairly reliable feedstock availability. Manufacturers are closely working with supply chain partners to anticipate demand and the recovery in the end use markets. Companies are repurposing their plants for manufacturing critical chemicals by using existing feedstocks.

Workers safety is a critical concern when determining when and how to reopen. The chemical industry is preparing to reopen plants in phases and reduce the number of employees in the workspace. In the chemical industry, more than 20% of the employees can work remotely without much loss of productivity, and this will help during the pandemic. Engineers that need to develop products using specialized equipment or test specimens may be required to work from labs and offices. Dow Chemical Company has enabled 2/3 of its workforce to work remotely and is promoting the safety of its employees as their top priority. Above issues are summarized in below figure.

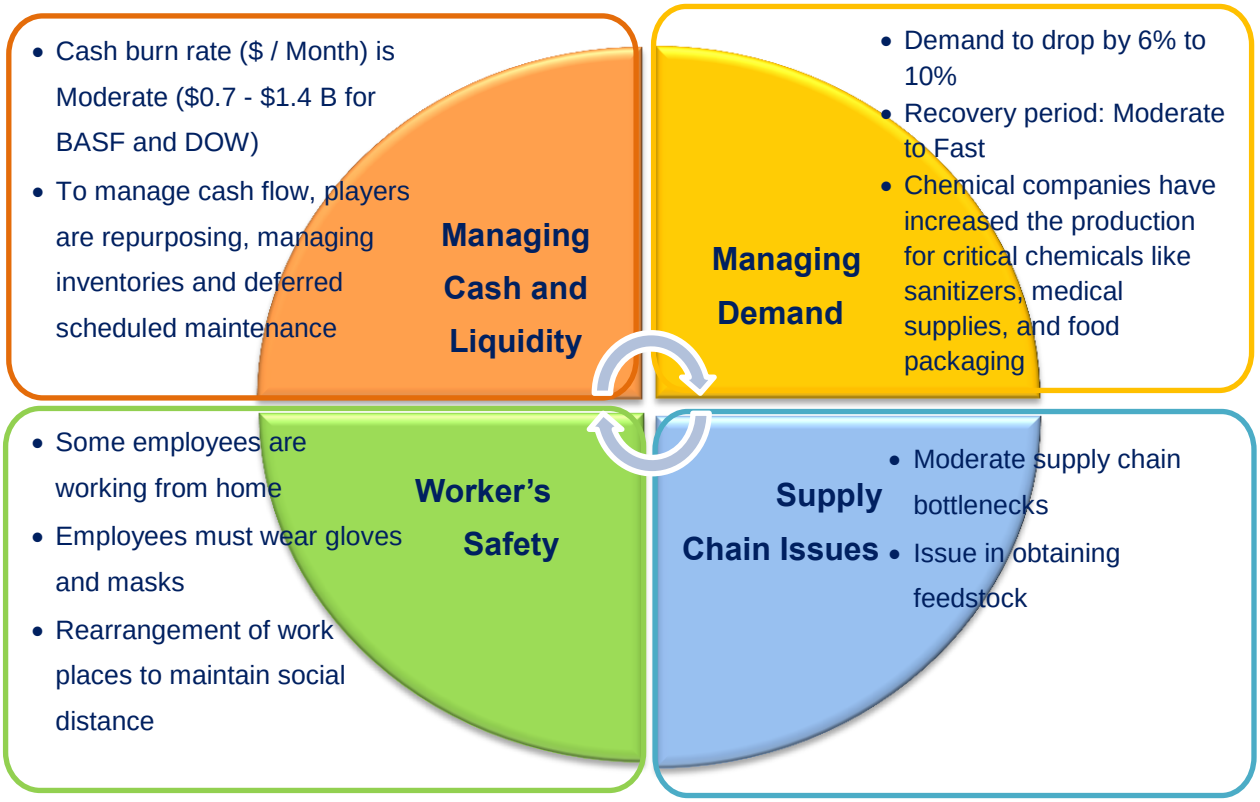

Figure 8: Navigating Through the Crisis in the Chemical Industry (Source: Lucintel)

Demand for chemicals is expected to recover gradually as the end use markets recover. The decline in sales and production in the chemicals industry is compounded by supply chain issues, workforce health challenges, etc. Companies are actively tracking supply and demand channels to make operational adjustments to scale production to the lower demand. Chemical companies have increased the production of critical chemicals like sanitizers, medical supplies, and food packaging.

"We had temporarily shut down production at a few sites due to the spreading of Coronavirus. We see the demand recovering from China but other parts of the world are critically facing COVID impact. We have 2/3 of employees working remotely, enhanced liquidity, cutting capex as attempts to manage through the Coronavirus pandemic."

Dow Chemical Company, USA

"Operations have been affected by COVID. We are facing low demand due to the decline from end use industries. We are expecting a decline in the revenue for the year 2020. However, we have taken proactive measures to support our operations through liquidity management, anticipating supply and demand"

LyondellBasell, China

3. Navigating Through the Crisis

To navigate through this global pandemic, companies are focusing their efforts on the following four main areas:

1. Managing Cash and Liquidity
2. Demand Management / Outlook
3. Workers Safety
4. Supply chain management

Impact of corona virus is huge for all the major industries. Industries are facing challenges for liquidity, demand uncertainty, supply chain issues, and worker's safety. Below spider chart shows the impact of these 4 issues on 6 major industries. To plot this chart, it was assumed that all these issues were normal during pre-COVID case. As a result of coronavirus, all these four areas are impacted and we compared how different industries are performing during this crisis.

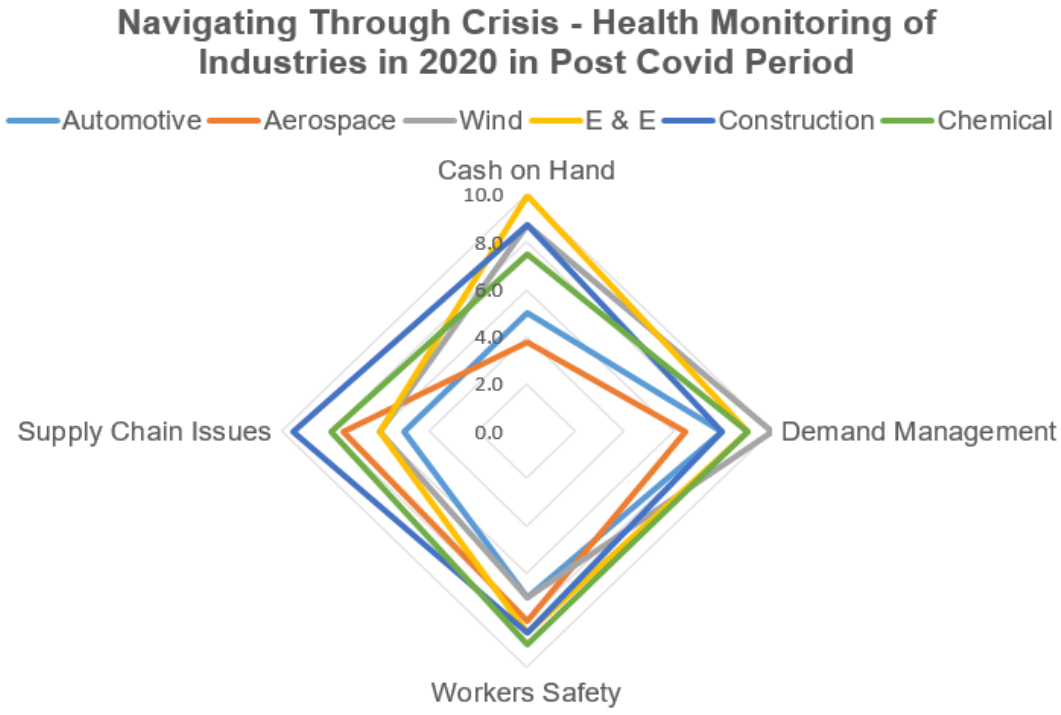

Figure 9: Health Monitoring of Industries in 2020 during Post COVID Period (Source: Lucintel)

Liquidity / Cash on Hand: The E&E, construction, and wind energy industries have good positions regarding cash on hand compared to the aerospace, automotive, and chemical industries, and they will be able to survive longer through the COVID crisis. The aerospace, automotive, and chemical industries have high monthly burn rates, which is likely to create cash problems during the crisis period. These industries need to maintain a balance between cash outflows and inflows.

Demand Management: Demand in all the industries has slowed due to the lockdown, production halts, rising unemployment and poor consumer confidence. Wind energy and E&E manufacturers are currently in a better position to manage demand as they have greater flexibility in production and outlook for their performance is not that bad.

Worker's Safety: COVID has created havoc, and social distancing is the only option to prevent the spread of the virus. Several regulatory bodies have issued various guidelines to enhance worker safety. Industries like wind energy and automotive have a higher risk of spreading the virus because workers work closely together in clusters. Proper distancing and temperature checking measures at regular time intervals can help the industries enhance safety standards.

Supply Chain Management: Although the COVID crisis has created supply chain problems for all industries, some including, automotive, and E&E are facing more challenging circumstances. These industries rely more on imports for some components and are therefore constrained because of trade restrictions.

In the next sections, the impact of the above 4 challenges are discussed on the 6 industries in the post-COVID market.

3.1 Managing Cash and Liquidity

During uncertain times, maintaining liquidity is a top priority for businesses to fund critical operations and to meet day-to-day fixed costs. Big companies are bleeding cash rapidly due to their overhead and the normal financing of operations. If the recovery does not happen soon, or if government support is not provided, then many companies may face bankruptcies as cash runs out waiting for a rebound.

The cash burn rate is particularly high in automotive and aerospace. For example, the burn rate of GM and Ford is roughly $2.0 billion to $2.5 Billion per month. Last month, Fiat Chrysler Automobiles secured almost $3.9 billion in additional credit. GM has drawn down about $16 billion from its revolving credit facilities. Ford said it will borrow $15.4 billion in unused amounts against two credit lines. The burn rate for major aircraft manufacturers ranges between $2.5 - $3.5 Billion / month. For example, Boeing has a burn rate of $2.5 - $3.0 Billion per month.

The table below compares the cash burn rate for various industries and how these industries are managing the 2020 COVID pandemic.

Industry	Cash Burn Rate ($B/Month)	Months of Available Cash (Based on Cash on Hand and Burn Rate)	Managing Cash and Liquidity
Automotive 	$2.0-$2.5 GM & Ford	3.0 - 4.0	• The high monthly cash burn rate for major OEMs is likely to create liquidity issues as operating cash flow diminishes rapidly during the crisis • OEMs are likely to burn through cash reserves in 3 to 4 months if cash is not managed properly • OEMs can cut nonessential operations, opt for temporary salary cuts, deferred dividend payouts, etc. to protect cash flow • GM and Ford have a monthly cash burn rate of $2.0 to $2.5 B
Aerospace 	$2.5 -$3.5 Airbus & Boeing	3.0 - 3.5	• Boeing & Airbus have burn rate of $2.5 and $3.5 B/month respectively • Aerospace OEMs likely to burn through cash reserves in 3 to 3.5 months if cash is not managed properly • OEMs can cut nonessential operation, opt for salary cuts, lay-offs, and production cuts to manage cash flow • In addition, government intervention is necessary to provide a boost to the industry to prevent bankruptcies and job losses
E & E 	$2.5 - $3.5 Apple & Samsung	7.0 – 20.0	• E&E industry has some of the most cash-rich companies such as Apple and Samsung that could more efficiently navigate through the COVID Crisis • Cash availability in the E&E industry is currently more than 6 months
Construction 	$0.4 - $0.6 DR Horton & ACS	4.0 – 15.0	• Construction companies employ small to mid-size companies • Cash availability in the construction industry is more than 6 months
Wind Energy 	<$0.5 Vestas & Nordex	7.0 – 12.0	• Cash burn rate for major OEMs in the wind energy industry is $100 M to $500 M per month • Wind energy OEMs are well-aligned to survive the turbulence and have good cash reserves to run operations for months without fallout • OEMs are ramping up their operations in countries like China to mitigate shuttered operations in other locations
Chemical 	$0.7 - $1.4 BASF & Dow Inc.	2.0 – 4.0	• Cash burn rate for major chemical companies, such as BASF and DOW are $0.7B and $1.4 B, respectively • Cash availability in the chemical industry is 2 - 4 months

Table 3: Cash Burn Rate for Various Industries and How to Manage Crisis

Key challenges in liquidity management:

1. With the sudden drop in demand, cash on hand is burning out. It's costing major companies billions per month to survive with a significant drop in demand
2. Complete or partial shutdown has reduced cash inflows to the businesses
3. Delayed receivables and rising payables
4. Supply chain disruptions and employee absenteeism has hampered productivity
5. Struggle to keep the working capital rolling
6. Access to capital / loans is limited

To navigate through this crisis faced by industries, Governments across globe have come up with stimulus packages and other initiatives as shown in the below chart. Recent stimulus packages announced by the governments of various nations not only help in unemployment crisis but stimulate short-term demand and also foster long-term growth.

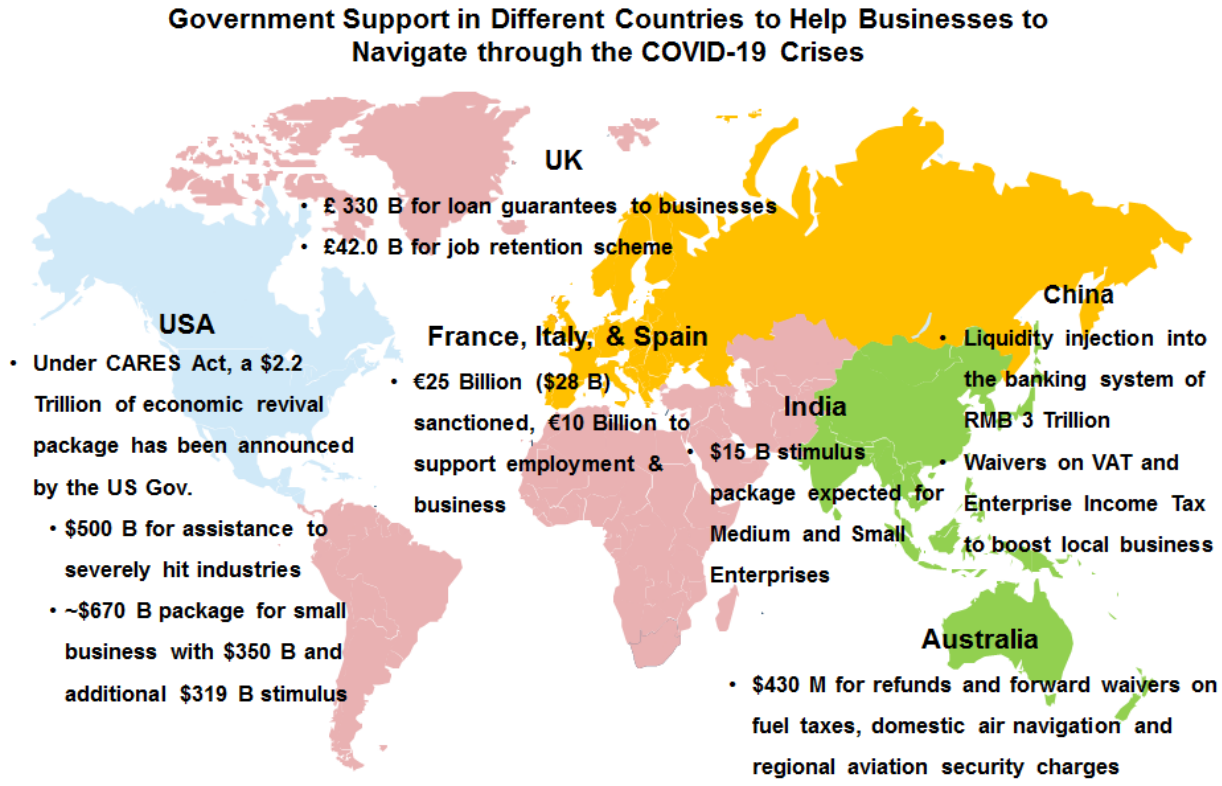

Figure 10: Government Support in Different Countries to Address the Crises of COVID-19

In addition, Central banks around the globe are trying to play a vital role in fostering stability and maintaining liquidity in the financial markets, as shown in the chart below. Some actions being considered by the Central Banks are:

- Reducing interest rates on safe assets and buying more government bonds, non-institutional bonds to push down their yields at various maturities, an action also known as quantitative easing
- Lending freely to banks, foreign central banks, other financial institutions, and even nonfinancial institutions with sufficient collateral.
- Infusing billions of dollars in the market to ensure liquidity
- In their capacity as financial sector supervisors, encouraging financial institutions to extend credit to firms adversely affected by the crisis.

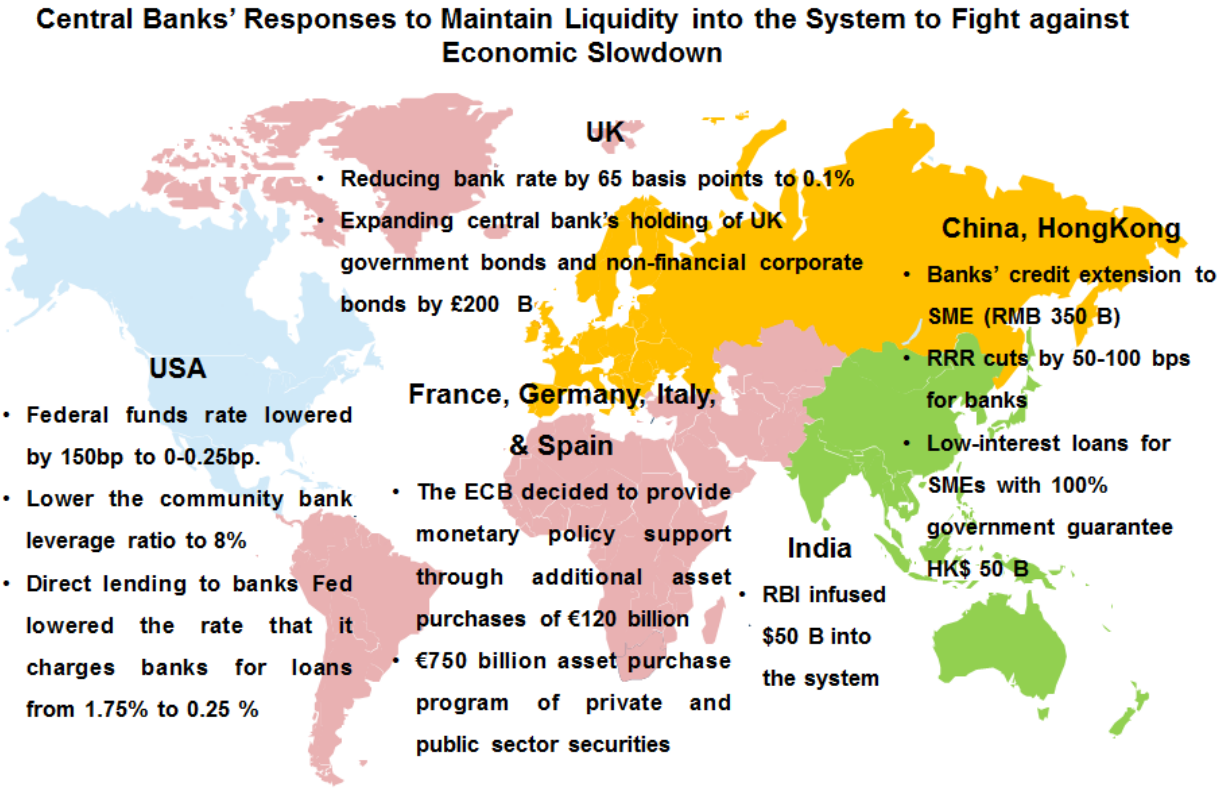

Figure 11: Central Bank's Responses of Various Countries to Fight COVID-19

(Source: Lucintel Analysis)

3.2 Demand Management

To stay in business, most companies are looking to restart their plants and assembly lines in May or June as costs mount with each passing day that the lines remain idle.

"The cost of staying closed is immense and eventually they will run out of time and die without new capital," said David Whiston, equity strategist for U.S. Autos at Morningstar Research Services. "That's why getting restarted even in late May or June is important."

It is really important for OEMs to evaluate the current situation and anticipate realistic demand for products to control expenses and avoid non-essential operations.

Focusing on right mix of products, which have proven track records and / or have survived the previous downturn with good sales could be a good strategy to increase profitability. Some examples for various industries are as below:

Automotive: Pickups like F150 in the US, hatchback & mid sedans (in APAC), SUVs in Europe.

Aerospace: B737, A320 platforms, Business & Private Jets that avoid close contacts with unknown passengers / change in seat designs to facilitate social distancing.

Wind Energy: Focus on turbine models with high order backlogs and more localized supply chain and delivery possibility

The table below compares the demand outlook and challenges for various industries and how quickly these industries are expected to recover the COVID crisis.

Industry	Demand Outlook in 2020	Recovery Period	Current Situation	Challenges
Automotive 	-20% to -30%	Moderate	Production Shutdown, Lockdown. Falling revenue throughout the value chain	• Absenteeism, restarting production at a lower rate, & fewer employees on the floor due to social distancing • Challenge to ensure required safety to employees
Aerospace 	-20% to -30%	Slow	Production Shutdown, Lockdowns. Falling revenue throughout the value chain	• Falling airline health, cancellation of existing orders, smaller new orders • Challenge to ensure required safety to employees • Absenteeism, restarting production at a lower rate, & fewer employees on the floor due to social distancing
E&E 	-6% to -10%	Fast	Sales decline due to lockdown	• Low consumer confidence • Higher rate of unemployment affecting purchasing power & discretionary spending
Construction 	-10% to -20%	Moderate to Fast	Slowdown in construction activity due to lockdown. Decline in financial health of the industry	• Higher rate of unemployment affecting purchasing power for new homes; lower investment in new facilities due to low demand • Low consumer confidence
Wind Energy 	10% to 15%	Moderate to Fast	Delay in the construction of farms, & difficulty to procure critical components	• Limited availability of skilled workforce to install new turbines and to provide MRO services to wind farms • Supply chain bottleneck due to lockdown
Chemical 	-6% to -10%	Moderate to Fast	Production shutdown	• Slowdown in all the key end use industries affecting the demand of chemical causing decline in the revenue

Table 4: Demand Management: Snapshot of the Impact of COVID on Six Industries (Source Lucintel)

For tier players & other supply chain partners, it is important to reevaluate key customers (OEMs) to ensure production readiness to properly manage the demand for parts / accessories for key platforms. Closely work with customers and OEMs to understand which

programs are expected to maintain and which programs are to be put on hold to re-allocate resources to the critical operational needs.

Key challenges in demand management:

1. Significant uncertainty in demand outlook. It is unknown when economy will once again be at pre-COVID (2019) levels
2. Demand is dropping due to lockdowns, store closures, and unemployment
3. The supply chain is disrupted, which creates uncertainties for forecasting demand
4. Historical data analysis can be key to predicting future outcomes

3.3 Worker's Safety

Most of the OEMs are working diligently to address the health and safety of workers due to the Coronavirus. Most OEMs are putting added safety measures in their plants and designing new safety procedures to ensure workers stay healthy. For example, the temperature of every person entering the plant or office will be measured twice and workers will be given masks and gloves to be used during working hours. Sanitizers will be used to clean office tables and work benches.

Facilities are preparing to reopen by adopting serious safety measures to ensure a safe production environment for all employees, and avoid the spread of the virus to other employees. Some are trying to implement social distancing measures by adjusting their shift structure, creating rotational working groups, rearranging workstations, adding distances between operations and employees, equipping masks, and making frequent use of sanitizers, gloves, etc. Companies must continuously keep an eye on employees to maintain wellbeing, and this includes steps like checking employee temperature and tracking COVID symptoms.

Below figure briefs the processes being adopted by companies to prevent the spread of virus amongst their employees

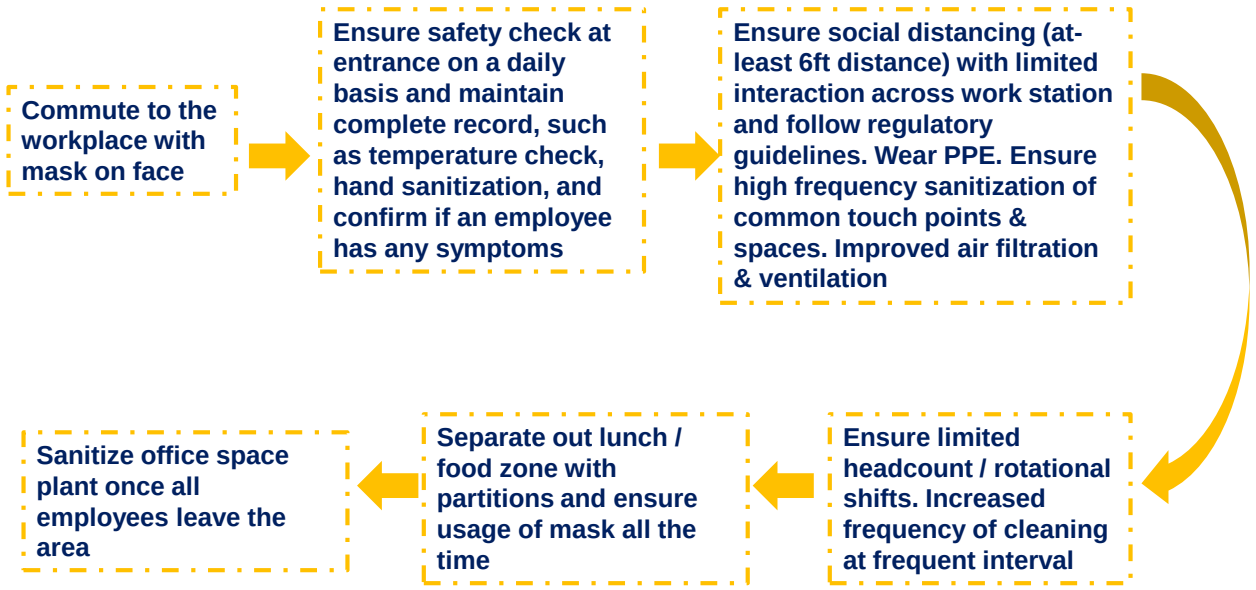

Figure 12: Processes Adopted by Companies to Prevent the Spread of Virus

3.4 Supply Chain Management

The COVID-19 pandemic may result in a long-term recovery for the supply chains, as companies focus on creating more flexibility, which means that supply contracts will be renegotiated to address the new reality.

Major manufacturers have already seen supply chain disruptions and have reevaluated their growth outlook for 2020. The impact of COVID-19 on the supply chain is expected to stay forever; companies will need to build resilient supply chains to cope with similar challenges in the future.

Key challenges in supply chain management:

1. Dependency in procurement of components from many countries, and cross-border shipments and travel restrictions pose a challenge for starting production
2. Global shutdown or partial production has created a shortage of critical components
3. Limited inventory for raw materials and components
4. Loss of productivity, increased cost of working
5. Price fluctuation

Below table summarizes the impact of supply chain issues and dependency on Chinese imports for various industries during COVID.

Industries	Supply Chain Disruption	Dependency on Chinese Imports	Insights
Automotive 			• China is the world's largest exporter of automotive components to all the major OEMs across different regions • In 2019, China exported more than $35 B worth of automotive components globally to OEM market • High dependency on Chinese imports and also plant shutdown and lockdown in different parts of the world has caused serious concern for the supply of critical components
Aerospace 			• Commercial aerospace OEMs tend to carry sufficient inventory for months • The critical supply chain challenge that the industry usually faces are long lead time, and relatively high dependence on sole suppliers for materials and parts

			• Limited dependency on Chinese exports • Lockdown and shutdown has made OEMs cut production, as part suppliers are also facing similar challenges
E&E 			• High-dependency on China for the import of parts and assemblies in the E&E market • Closed borders and countries under some form of lockdown affected the movement of critical components, have halted production • Delays in the shipment of parts and final products by more than 4 weeks • Revival of Chinese operation brings a positive sign
Construction 			• The US and the EU regions are dependent on China for materials and other supplies. • Restrictions on imports from COVID-affected nations could put considerable strain on the supply chain and could cause delays in projects • Port closures and sealed borders restrict the movement of labor, materials, and equipment • Absenteeism, high lead-time could cost millions of dollar to projects
Wind Energy 			• Aggressive lockdown measures in major European countries, such as Spain, France, and Italy restricted the movement of workers, parts, etc. creating pressure on the supply chain • US, Mexico closed borders, which also impacted the supply of wind blades • China's supply of wind blade to the US is also impacted • Shortage of critical components due to COVID outbreak to EU market
Chemical 			• Chemical companies are facing decline in demand, supply disruption and plant closure impacting retail and purchasing prices of raw materials • Moderate dependency on China for raw material supplies

Level of Disruption / Dependency on Import	**Low**	**Medium**	**High**

Table 5: Supply Chain Disruption across Industries (Source: Lucintel)

Note: The colors above are used to highlight the impact of COVID on the supply chain at the global level and also the dependency of the industry on Chinese imports.

Companies generally had been working with minimum or zero inventories to minimize working capital but this caused problem due to shipment crisis. Automotive, aerospace, wind and E&E industries took the hit, due to dependency on imports of components for production. Global automotive production has a strong dependence on China (see graph below). China stands out as the single largest market with the highest light vehicle production (~25 m units), followed by EU, Other Asia, and North America. China is also the world's largest consumer of light vehicles, creating an annual demand of ~26 m units.

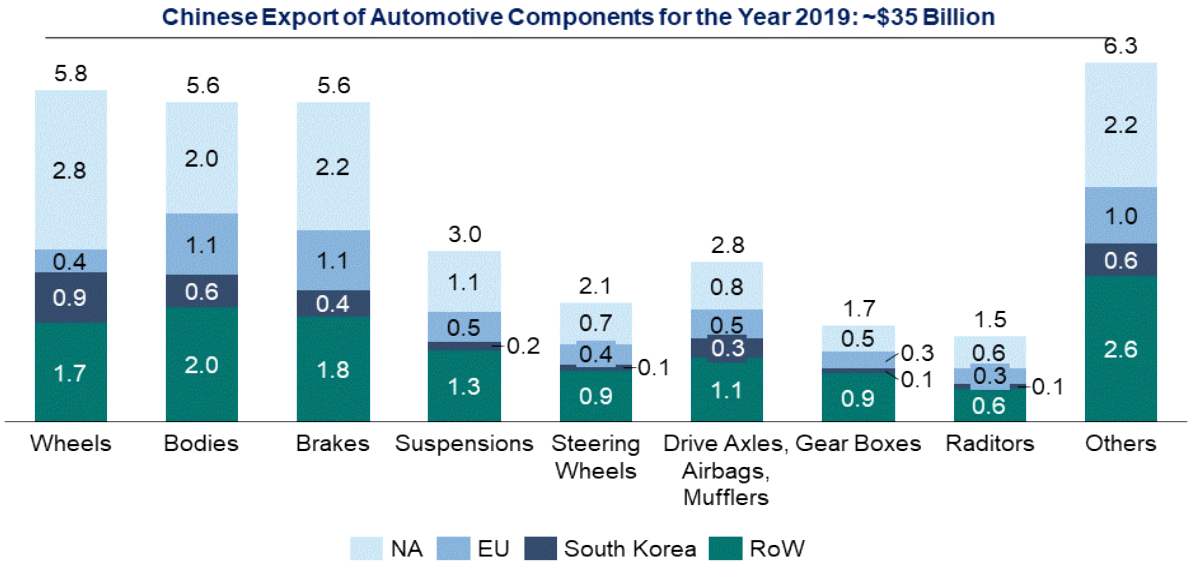

Figure 13: Chinese Export of Automotive Component for the Year 2019 (Source: Lucintel)

The APAC region is the hub for the global E & E industry. China is the major source of low-cost manufacturing for major global players. The supply chain for the E&E industry was severely affected by the Coronavirus outbreak in China. Players like Samsung, Apple and others faced declines in shipments in other parts of the world and had to shut down operations and stores.

The US is the largest exporter with a share of more than 40% in the global exports for aerospace products as shown in below figure. The North American region holds the highest share in aerospace exports globally, accounting for >45%, followed by Europe with >42% share. Recent macro-economic trends will affect the export from above countries creating supply chain disruptions for the overall industry.

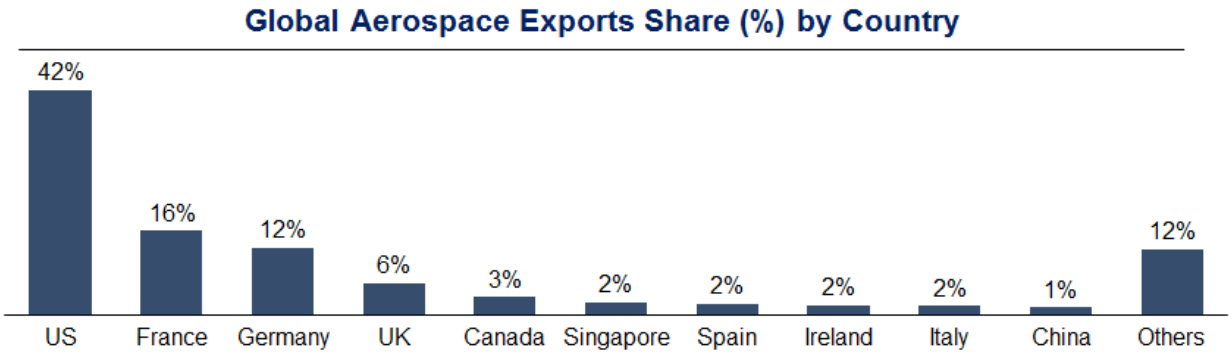

Figure 14: Global Aerospace Exports Share (%) by Country

4. Future / Touchless Economy

The COVID outbreak has had an impact on psychology and consumer sentiments and thus created a need for a touchless economy, which will allow the growth of industry 4.0, smart homes, robots, IoTs, and Artificial Intelligence (AI). The touchless economy includes any economic activity performed without close interaction or being physically present in the place of the transaction. For example, during the quarantine period, we have seen a shift towards online meetings, online education, telemedicine, and online shopping from Amazon, Flipkart, etc. to reduce human contact. We are also seeing increased demand for robots in hospitals, factories and daily life. For example, a robot can allow healthcare workers to remotely take temperatures and measure blood pressure and oxygen saturation from patients hooked up to a ventilator. Robot can also disinfect hospitals, airport, factories, work space, and sensitive areas with ultraviolet light. Drones and robots are also used to watch for public works and public safety to identify violations of stay-at-home restrictions, etc.

We are also expecting a shift towards flexible and smart manufacturing, which can help part fabricators to maintain a balance between their inventory and actual demand. During post-covid period, there will be significant increase in digital transformations in payments, receipts, supply chains, and many other aspects of business to increase efficiency. Companies who have already invested in smart manufacturing or contactless technologies will be doing better to improve production efficiencies as well as workers safety to avoid further transmission of the virus. Major manufacturers such as Boeing, Airbus, Safran, Honeywell, GE Aviation, General Motors, and Ford have already invested in smart manufacturing or contactless technologies to realize reductions in costs, wastage, and production time.

In addition, during this last one month of stay at home, or lockdown, companies assessed the productivity of employees working from home. In many manufacturing industries, we found that almost 25% of employees can work from home without losing productivity. In the service and software industries (IT), companies are saying that they can have almost 75% to 100% of employees work from home. For example, TCS (Tata Consulting Services), which has 448,000 employees globally suggested that they can have 75% of their employees work from home by 2025, from about 20% - 25% work from home today. This new model will require far

less office space. The decision came after the firm briskly moved 90% of its workforce to an operating model called Secure Borderless Work Spaces. Many other IT firms used similar models during the lockdown period and found little to no loss of productivity while working from home. It also saved driving time to the office, which is usually 1 hour to 2 hours each way to an office in major cities.

In a touchless economy, there will be an increase in demand for autonomous vehicles, autonomous / smart factories and additive manufacturing (3D printing). Smart manufacturing will allow new efficiencies in productivity, utilization, throughput and maintenance. For example, General Motors is growing its use of connected robots that can help the automaker identify maintenance problems before they occur. Uber recently said that since 80% of the riding cost is the expenses of the driver, use of autonomous vehicles will increase its profitability. However, there are still challenges in autonomous vehicles because they lack the ability to identify and classify objects until they are nearby, which causes accidents.

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